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Body Satisfaction, Weight Gain, and Binge Eating Among Overweight Adolescent Girls

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Abstract

Objective—To examine if body satisfaction is associated with body mass index (BMI) change and whether it protects against the development of frequent binge eating among overweight and obese adolescent girls.

Methods—We used prospective data from 9 waves of an ongoing cohort study of adolescents, the Growing Up Today Study. At enrollment in 1996, participants were 9 to 14 years old. Questionnaires were mailed to participants annually until 2001, then biennially through 2007. Girls who were overweight or obese in 1996 were included in the analysis (n=1 559). Our outcomes were annual change in BMI and incident frequent binge eating, defined as binge eating at least weekly and no use of compensatory behaviors.

Results—At baseline, 57.2% of the overweight and obese girls were at least somewhat satisfied with their bodies. During 11 years of follow-up, 9.5% (95% confidence interval (CI) [7.8, 10.8]) of the girls started to binge eat frequently. Controlling for BMI and other confounders, overweight and obese girls who reported being at least somewhat satisfied with their bodies made smaller BMI gains (β=−0.10 kg/m^2, 95% CI [−0.19, −0.02]) and had 61% lower odds of starting to binge eat frequently (odds ratio (OR)=0.39, 95% CI [0.24, 0.64]) than their less satisfied peers. Compared to girls who were the least satisfied with their bodies, girls who were the most satisfied had 85% lower odds of starting to binge eat frequently (OR=0.15, 95% CI [0.06, 0.37]). The association between body satisfaction and starting to binge eat frequently was stronger for younger adolescents than older adolescents.

Conclusions—While body dissatisfaction is common among overweight and obese girls, body satisfaction may protect against excessive weight gain and binge eating. Prevention of body dissatisfaction must begin early and should be considered as a component of both obesity and eating disorder prevention programs.

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Keywords

Body satisfaction; body dissatisfaction; binge eating; weight gain; adolescent obesity

INTRODUCTION

Overweight and obesity are common among adolescents in the United States[1] and can have serious health consequences[2]. Body dissatisfaction, defined as having a negative subjective evaluation of one's physical body[3], is common, and even normative, among females[4]. Rates of body dissatisfaction increase with body mass index among adolescent girls[5-7] and are particularly high among those who are overweight or obese[7,8]. Although body dissatisfaction has been shown to increase the risk for several adverse outcomes, including disordered eating behaviors[9-11], low self esteem[12], and depressive symptoms[9,12-14], its association with adverse weight-related outcomes has received relatively little attention. Given the high rates of overweight and obesity among adolescents in the United States and the belief by some experts that a moderate amount of body dissatisfaction may serve as a motivator for healthy lifestyle change[15], support for promoting body satisfaction among overweight and obese adolescents is not universally accepted. Clinicians may find it incongruous to promote body satisfaction while also encouraging weight loss for the purposes of optimizing health.

There is no empirical evidence to support that body dissatisfaction motivates overweight and obese youth to adopt healthier behaviors or gain less weight and, in fact, some evidence suggests that the opposite may be true. Van den Berg and Neumark-Sztainer observed that among 376 overweight and obese girls in Minnesota, those with higher body satisfaction had smaller BMI increases over 5 years[16]. Although not studied among overweight and obese adolescents separately, adolescents with higher body satisfaction are more physically active and are less likely to diet or use unhealthy weight control behaviors than their less satisfied peers[17]. Taken together, these findings suggest that enhancing body satisfaction among overweight and obese girls could promote healthier weight-related behaviors and lessen weight gain.

In addition to the relationship between body dissatisfaction and elevated BMI seen among adolescent girls[5,6,8], several cross-sectional studies have found a strong correlation between body dissatisfaction and binge eating, which itself is a risk factor for weight gain. Binge eating disorder (BED) is an eating disorder that is characterized by recurrent episodes of binge eating that occur at least once a week without the use of inappropriate compensatory behaviors[18]. The estimated lifetime prevalence of BED among female adolescents is 2.3%[19]. Overweight and obese adolescents are far more likely than their healthy weight peers to report binge eating[20,21]. Moreover, greater body dissatisfaction is seen in women with BED than in overweight and obese women who do not binge[22-24]. Although one study found that body dissatisfaction was a risk factor for binge eating onset, the magnitude of the association was small[25]. No large longitudinal studies have investigated this association and none have assessed whether age modifies the relationship. Moreover, the association between body satisfaction and the onset of binge eating behaviors has not been investigated among overweight and obese adolescents. Exploring this relationship is an important area of scientific investigation because of the substantial morbidity associated with binge eating. Girls who binge eat frequently are more likely to suffer from mood disorders, anxiety disorders, behavioral disorders, and substance abuse[19], as well as more likely to become overweight or obese[26].

The aim of the current study was to investigate the associations of body satisfaction with yearly BMI change and incident frequent binge eating in a cohort of overweight and obese adolescent girls living throughout the United States. We hypothesized that body satisfaction would predict lower yearly BMI gain and protect against incident frequent binge eating.

SUBJECTS AND METHODS

Subjects

Participants are members of the Growing Up Today Study (GUTS), an ongoing cohort study of adolescents throughout the United States that was established in 1996. They are the offspring of women participating in the ongoing Nurses' Health Study II (NHSII), a cohort study of over 116 000 female registered nurses[27]. Participants were 9 to 14 years old at enrollment in 1996. Approximately 68% of the invited female participants (n=9 039) returned completed questionnaires, thereby assenting to participate in the cohort study. Participants were asked to complete questionnaires annually from 1996 to 2001, and then biennially through 2007. All girls from the 1996-2007 waves of GUTS who were overweight or obese in 1996 and provided information in one or more consecutive cycles (n=1 559) were included in the present analysis.

The study was approved by the human subjects committees at Children's Hospital Boston and Brigham and Women's Hospital in Boston, MA.

Measurement

Predictors—Body satisfaction was our primary exposure. Body satisfaction was assessed using a single item from the validated McKnight Risk Factor Survey (MRFS)[28]. Participants were asked the question, "In the past year, how happy have you been with the way your body looks?" with the response categories: *totally, a lot, pretty much, a little*, or *not at all* on the 1996-1999 questionnaires and again in 2001. This item has adequate internal consistency (r=0.75 for middle school girls, r=0.69 for high school girls) with other items on the body appearance/appraisal subscale of the MRFS[28]. Participants who answered *totally, a lot*, or *pretty much* to this question were considered to be at least somewhat satisfied with the way their bodies looked and therefore were classified as having body satisfaction. Participants who answered *a little* or *not at all* to this question were classified as having low body satisfaction.

Hours per week spent watching television (TV), which is a known predictor of body dissatisfaction among girls[29], was collected on each survey using either a single item which asked about weekly TV viewing or separate questions which asked about weekday and weekend viewing. As part of the NHS II study, height and weight has been self-reported by the mothers of GUTS participants. Maternal BMI was calculated from self-reported height assessed in 1989 and weight reported biennially from 1995 through 2007. Participants whose mother had a BMI ≥25 were classified as having an overweight/obese mother.

Outcomes—Our two outcomes were annual change in BMI and incident frequent binge eating. BMI was calculated from self-reported height and weight, which were assessed at every questionnaire cycle. Age- and sex-specific International Obesity Task Force cutoffs[30] were used to classify participants' weight status. All analyses were restricted to females classified as overweight or obese. Although studies of the validity of self-reported weight and height find that adolescents provide valid information[31-33], some girls who may truly be overweight but underreported their weight would be excluded from these analyses. Further, overweight and obese girls are consistent in underreporting their weight, thus weight change based on serial self-reported weights is highly valid[34]. Since change in BMI is the preferred

measure of change in adiposity in longitudinal studies of adolescents[35,36], we modeled weight change as change in BMI rather than change in BMI z-score or percentile. Annual BMI change (in kg/m^2) was calculated by dividing the difference in self-reported BMI between consecutive survey waves by the number of years elapsed between self-reports.

Binge eating, which was assessed at every survey wave, was defined as frequent overeating episodes (During the past year, how often have you eaten so much food in a short period of time that you would be embarrassed if others saw you?) and reporting a loss of control (Did you feel out of control, like you couldn't stop eating, even if you wanted to stop?). Participants who reported at least weekly binge eating episodes and did not use compensatory behaviors, such as self-induced vomiting or laxatives, were defined as binge eating frequently based on frequency criteria for BED proposed for the fifth edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-5)[18]. We additionally looked at incident weekly binge eating episodes with or without use of compensatory behaviors as an outcome. This outcome included mostly individuals with frequent binge eating, as well as cases of subthreshold or full criteria bulimia nervosa (BN).

Analysis

We used Kaplan-Meier time-to-event analysis to estimate time to incident frequent binge eating. Generalized estimating equations with time-varying covariates were used for multivariable lagged longitudinal analyses of body satisfaction predicting BMI change (identity link) and development of frequent binge eating (logit link) over the following year. Generalized estimating equations have an independent working covariance matrix and empirical variance to account for the correlation between siblings. Girls who met the criteria for frequent binge eating at baseline were censored from the frequent binge eating outcome analyses and incident cases were censored from analyses of subsequent time periods. All statistical models were adjusted for age. Fully-adjusted models were additionally adjusted for BMI, TV viewing, and maternal weight status in the previous time period. Tanner stage was considered as a covariate, but did not appear to confound the relationships under study, thus was not included in the multivariate-adjusted models.

For the primary analyses, we treated body satisfaction as a dichotomous variable, but also explored the shape of the association by using indicator variables representing the full range of body satisfaction from *not at all to* a *lot/totally*. Because there were no incident frequent binge eating cases among girls who reported being *totally* happy with the way their body looked, the *a lot* and *totally* categories were combined for this analysis. To assess if age modified the associations observed, we conducted an addition secondary analysis stratified by age group at each wave (younger adolescents, 9 to ≤15 years vs. older adolescents, >15 to 25 years). We conducted a complete case analysis. To investigate whether bias was introduced by restricting to complete cases, we conducted analogous analyses with indicator variables to denote missing information for TV viewing (≤2 hours/day, >2 hours/day, or missing) and maternal weight status (healthy weight, overweight/obese, or missing).

We report beta estimates (β) and 95% confidence intervals (CI) for the BMI change analyses and odds ratios (OR) and 95% CIs from the model predicting the development of frequent binge eating. All p values are 2-sided, with $p<0.05$ considered statistically significant. All analyses were conducted with SAS software (version 9.1; SAS Institute, Cary, NC).

RESULTS

At baseline, the mean (sd) age of the females was 11.8 (1.6) years (Table 1). The mean (sd) BMI among all participants was 23.7 (2.6) and 93% of the sample was white. Girls who were at least somewhat satisfied with their bodies had a mean BMI of 23.1 (2.4), which was

lower than the mean of 24.6 (2.6) seen among girls with low body satisfaction ($p \leq 0.0001$). At baseline, over half (57%) of the overweight and obese 9-14 year old girls reported being at least somewhat satisfied with the way their bodies looked and 59% had a mother who was overweight or obese. Body satisfaction decreased over time. Less than half (47%) of the 13-18 year old girls reported being at least somewhat satisfied with the way their bodies looked in 2001.

In age-adjusted models, there was no significant association between body satisfaction and annual change in BMI (Table 2). After further adjusting for BMI, we observed that overweight and obese girls who were at least somewhat satisfied with their bodies made smaller annual gains in BMI ($\beta = -0.09$ kg/m^2, 95% CI=−0.17, −0.01) compared to more dissatisfied girls. The association was virtually unchanged when the analyses also controlled for TV viewing and maternal weight status ($\beta = -0.10$ kg/m^2, 95% CI=−0.19, −0.02). We observed a significant linear trend (p=0.02) for smaller BMI gains with higher body satisfaction such that those reporting being *a lot* or *totally* satisfied gained 0.13 fewer BMI units per year than did those who were *not at all* satisfied with their bodies.

At baseline in 1996, 1.7% of all overweight and obese girls in GUTS met criteria for frequent binge eating. After excluding prevalent cases of frequent binge eating at baseline, 136 girls (Incidence=9.5%, 95% CI=7.8, 10.8) in our sample met criteria for frequent binge eating at least once during 11 years of follow-up. An additional 25 girls reported incident weekly binge eating with the use of a compensatory behavior (i.e., subthreshold or full criteria BN) during follow-up. Girls who were at least somewhat satisfied with their bodies had 61% lower odds of developing BED (OR=0.39, 95% CI=0.24, 0.64) in the subsequent 12-24 months compared to those who were less satisfied (Table 3). Moreover, compared to girls who were *not at all* satisfied with the way their bodies looked, girls who reported being *a lot* or *totally* satisfied with their bodies had 85% lower odds of developing BED (OR=0.15, 95% CI= 0.06, 0.37).

To investigate whether age modified the associations, we conducted an exploratory age-stratified analysis (Table 4). We observed that the protective effect of higher body satisfaction on BMI change was seen only in younger adolescents ($\beta = -0.18$ kg/m^2, 95% CI=−0.31, −0.06). In contrast, higher body satisfaction was protective against frequent binge eating in both age groups, although the effect was strongest in the younger adolescents (OR=0.34, 95% CI=0.17, 0.68).

Findings from analyses conducted with indicator variables for the missing TV viewing and maternal weight status covariates were not materially different from the complete case analysis (data not shown). Analyses that predicted incident weekly binge eating with or without using compensatory behaviors had findings similar to the frequent binge eating analyses (data not shown).

DISCUSSION

Among our sample of 1 559 overweight and obese adolescent girls, those who were at least somewhat satisfied with their bodies gained less weight and were less likely to develop frequent binge eating than those who were less satisfied with their bodies. During the 11 years of follow up, 9.5% of the adolescent females in our sample met criteria for frequent binge eating at least once, demonstrating that binge eating is common among overweight and obese individuals[20-24].

Our finding that girls who were at least somewhat satisfied with their bodies made smaller yearly BMI gains than their more dissatisfied peers supports earlier research from a study of youth in Minnesota[16] and. Although the effect size of 0.1 may be too small to be considered

a clinically significant difference in BMI, our findings argue against the supposition that body dissatisfaction among overweight and obese individuals may be desirable because it would serve as a motivator for weight loss or that overweight and obese adolescent girls who are satisfied with their bodies are a "risk group"[37]. Better understanding of the source of their resilience could inform intervention efforts to enhance body satisfaction in other girls and, thus, possibly lessen excessive weight gain.

This study is the first to report that overweight and obese adolescent girls who are least somewhat satisfied with their bodies are much less likely than their less satisfied peers to develop BED. However, related evidence supports our finding. Stice, Presnell, and Spangler previously identified body dissatisfaction as a risk factor for the onset of at least one episode of binge eating in a longitudinal study of 231 girls from two private high schools in Northern California[25]. In addition, in a prospective study of adolescents by Neumark-Sztainer et al., low body satisfaction was associated with more binge eating in boys, but not girls[17]. Further support for our findings comes from a weight control trial of overweight and obese women, which found that, independent of weight change, improved body satisfaction among participants was associated with a greater reduction in binge eating[22].

We found that body satisfaction predicted less BMI gain in younger adolescents only and observed a stronger protective effect of body satisfaction on starting to binge eat frequently for younger adolescents compared to older adolescents. These observations are similar to findings by Paxton et al.[12] who demonstrated that body dissatisfaction predicted depressive mood and low self-esteem in early adolescent girls, but not mid-adolescent girls. The authors posited that girls who are vulnerable to the negative consequences of body dissatisfaction are likely to suffer the adverse effects earlier in adolescence and that these effects would then be sustained, rather than first occur, in later adolescence[12]. Taken together, these findings highlight the importance of early prevention of body dissatisfaction. Specifically, obesity and eating disorder prevention interventions which target body dissatisfaction should begin before adolescence.

The breadth of evidence that links body dissatisfaction to negative outcomes such as lower physical activity levels[17], use of unhealthy weight control behaviors[17], disordered eating[9-11], depressive mood[9,12-14], weight gain[38], and now binge eating suggests that greater attention should be paid to preventing body dissatisfaction. Our findings suggest that interventions that enhance body satisfaction could reduce unhealthy weight gain, which is fundamental to preventing the consequences of adolescent obesity, such as type 2 diabetes, obstructive sleep apnea, hypertension, dyslipidemia, and metabolic syndrome[2]. Because binge eating is associated with excess weight gain in adolescents[39] and individuals with BED are often overweight or obese[40], reducing binge eating may also reduce obesity-related health burden.

Risk factors for body dissatisfaction may be salient targets for promoting body satisfaction, decreasing unhealthy weight gain, and preventing binge eating onset among adolescents. One such target is perceived pressure to be thin[41] which may come from sources such as parents[42], peers[43], and the media[38,44,45]. Experiences of appearance-based teasing[46] and weight-based discrimination[47] are also significant predictors of body dissatisfaction. Victims of weight bias who believe weight-based stereotypes are particularly susceptible to body dissatisfaction[47] and may be more likely to binge eat in response to stigma and be less motivated to lose weight[48]. These findings highlight the importance of bolstering efforts to reduce weight-based discrimination, while also targeting perceptions of overweight and obese individuals about the acceptability of such discrimination.

Strengths of this study include its prospective design, geographically diverse sample, validated measures, and large sample size. These qualities, in addition to our ability to adjust for known correlates of body dissatisfaction and binge eating, reduce the likelihood of incorrect inference. The study, however, has several limitations. First, body satisfaction was assessed using a single-item measure which provides less robust information than comprehensive, empirically-validated scales[49]. However, one would expect the misclassification caused by using an abbreviated measure would bias the results towards the null. Thus, our estimates may be conservative. An additional limitation of our study relate to drawbacks of self-reported binge eating. Studies have demonstrated a number of limitations of self-reported binge eating in children and adolescents, particularly when it comes to measuring objective bulimic episodes, the hallmark of BED[50]. The inclusion of instructions defining "large amount" has been useful in reducing these limitations[50,51], though such instructions were not included in our study. Another limitation of our study is that our sample is more than 90% white and likely under represents youth of low socioeconomic status (SES) because the our sample consists of children of nurses, thus it is unclear if our results are generalizable to racial/ethnic minorities or adolescents of low SES. In addition, although our measures have been validated, we relied on self-reported information.

This study builds on the existing literature that recognizes body dissatisfaction as a risk factor for myriad negative outcomes during adolescence, and specifically among overweight and obese girls. Our findings support the notion that obesity prevention and treatment interventions might be enhanced by focusing greater attention on promoting body satisfaction[3,52,53]. Addressing both obesity and eating disorder prevention in the same program has both theoretical[54,55] and empirical[56-60] support and would enhance primary prevention efforts for obesity. Our data suggest that promoting body satisfaction among overweight and obese girls may also strengthen secondary prevention since girls with body satisfaction have lower weight gain and are less likely to start binge eating. Promotion of body satisfaction may be an important component of both obesity and eating disorder prevention and treatment programs.

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Table 1

Baseline characteristics of 1559 overweight and obese adolescent females in the Growing Up Today Study

	Mean (SD) or percentage
Age (years) (n=1 559)	11.8 (1.6)
BMI (kg/m^2) (n=1 559)	23.7 (2.6)
Body satisfaction (% prevalence) (n=1 543)	57.2%
Television viewing (% watching greater than 2 hours/day) (n=1 559)	52.9%
Maternal weight status (% overweight/obese) (n=1 481)	59.0%

SD, standard deviation; BMI, body mass index; BED, binge eating disorder

Table 2

Association of body satisfaction with yearly BMI change[a]

	Age adjusted β (95% CI)	Age and BMI adjusted β (95% CI)	Fully adjusted[b] β (95% CI)
Body satisfaction[c]	0.01 (−0.06, 0.08)	−0.09 (−0.17, −0.01)	−0.10 (−0.19, −0.02)
"How happy are you with way your body looks?"			
Not at all	0 (reference)	0 (reference)	0 (reference)
A little	0.00 (−0.10, 0.11)	−0.01 (−0.12, 0.10)	−0.02 (−0.15, 0.10)
Somewhat	−0.01 (−0.11, 0.10)	−0.08 (−0.18, 0.03)	−0.12 (−0.24, 0.00)
A lot/Totally	0.01 (−0.10, 0.11)	−0.10 (−0.22, 0.01)	−0.13 (−0.26, 0.00)
ptrend	0.58	0.03	0.02

BMI, body mass index; CI, confidence interval

[a] All models adjust for clustering within family using generalized estimating equations

[b] Fully adjusted model adjusted for age, BMI, TV viewing, and maternal overweight/obesity

[c] Low body satisfaction is referent group

Table 3

Association of body satisfaction with starting to binge eat frequently[a]

	Age adjusted OR (95% CI)	Age and BMI adjusted OR (95% CI)	Fully adjusted[b] OR (95% CI)
Body satisfaction[c]	0.41 (0.27, 0.63)	0.45 (0.29, 0.70)	0.39 (0.24, 0.64)
"How happy are you with way your body looks?"			
Not at all	1 (reference)	1 (reference)	1 (reference)
A little	0.43 (0.27, 0.67)	0.41 (0.26, 0.66)	0.43 (0.25, 0.74)
Somewhat	0.39 (0.25, 0.62)	0.42 (0.26, 0.68)	0.38 (0.22, 0.67)
A lot/Totally	0.11 (0.05, 0.26)	0.12 (0.05, 0.29)	0.15 (0.06, 0.37)
ptrend	<0.0001	<0.0001	<0.0001

OR indicates odds ratio; CI, confidence interval

[a] All models adjust for clustering within family using generalized estimating equations

[b] Fully adjusted model adjusted for age, BMI, TV viewing, and maternal overweight/obesity

[c] Low body satisfaction is referent group

Table 4

Age-stratified association of body satisfaction with yearly BMI change and starting to binge eat frequently[a]

	BMI change Fully adjusted[b] β (95% CI)	Binge eating Fully adjusted[b] Odds Ratio (95% CI)
Body satisfaction[c]		
Age ≤15 years	−0.18 (−0.31, −0.06)	0.34 (0.17, 0.68)
Age >15 years	−0.04 (−0.14, 0.06)	0.48 (0.23, 0.99)

OR indicates odds ratio; CI, confidence interval; BMI, body mass index

[a] All models adjust for clustering within family using generalized estimating equations

[b] Fully adjusted model adjusted for age, BMI, TV viewing, and maternal overweight/obesity

[c] Low body satisfaction is referent group